Reprod. Nutr. Dévelop., 1984, **24** (4), 483-486.

Relationship between *rete testis* fluid secretion and testicular structure in the ram

Claudine PISSELET, Christine PERREAU, Marie-Thérèse HOCHEREAU-de REVIERS

Station de Physiologie animale, I.N.R.A. Nouzilly, 37380 Monnaie, France.

Summary. A rete testis cannulation technique was used to compare the secretion of *rete testis* fluid with the production of spermatozoa and histological testicular parameters in Ile-de-France rams. Thirteen testes were cannulated and rete testis fluid variables were compared to histological variables of the same testis. The rate of flow of rete testis fluid was significantly ($P \leq 0.05$) correlated with testicular size, the area of the walls of the seminiferous tubules and the volume of the Leydig cells. These two latter factors accounted for 66 % of the variation in the flow of rete testis fluid.

Introduction.

Seasonal variations in the flow of rete testis fluid (RTF) and production of spermatozoa have been observed in the ram (Dacheux *et al.*, 1981). Modifications of testicular structure and activity according to season or endocrine status have previously been demonstrated in the ram (Ortavant, 1959 ; Hochereau-de Reviers, Loir and Pelletier, 1976 ; Courot and Ortavant, 1981) but nothing is known of the relationship between the somatic and germ cell populations of the testis and its ability to secrete fluid (Waites and Gladwell, 1982).

The aim of the present study was to relate fluid secretion to the somatic cell populations of the testis.

Material and Methods.

In 8 adult Ile-de-France rams, RTF was collected from one testis only (3) or from both testes simultaneously (5) during autumn (October and November) as described by Dacheux *et al.* (1981). When the rams regained consciousness after surgery, they were retained in a harness and the RTF flowing from the cannula was collected in a sterile cylinder kept at 4-7 °C and changed every 24 h. The volume of fluid collected was measured and the concentration of the spermatozoa

was estimated by haemocytometry. The mean flow rate and the mean concentration of spermatozoa were calculated from measurements obtained during the first four days of cannulation (Dacheux *et al.*, 1981). The testes were then removed and fixed in Bouin Hollande solution, and the interbular and tubular tissues were analysed quantitatively as previously described (Hochereau-de Reviers *et al.*, 1979). Correlations between histological variables and fluid flow were calculated from all the data (Snedecor, 1956).

Results.

The mean values of the histological variables, rete testis flow, concentrations of spermatozoa in RTF and sperm production per testis are given in table 1. Correlations between the variables were calculated (table 2).

TABLE 1

Histological and rete testis fluid parameters in the testes (n = 13) *of Ile-de-France rams.*

	Mean	Standard error	Range
Testis weight (g)	300	17.5	211-428
Seminiferous tubule diameter (μm)	234	4.6	161-255
Seminiferous tubule total length/testis (m)	3 502	188	2 484-4 566
Tubular wall total area/testis (dm^2)	2.57	0.15	19.4-35.6
Sertoli cell total number/testis × 10^8 (uncorrected)	60.2	4	42.5-110
Total volume intertubular tissue/testis (cm^3)	42.7	3	27.7-57.5
Total volume of Leydig cells/testis (cm^3)	5.2	0.4	3.2-6.7
Individual volume of Leydig cells (μm^3)	265	9	211-320
Total number of Leydig cells × 10^8	18.2	1.4	9.9-28.4
Total volume of blood and lymph vessels/testis (cm^3)	13.5	0.9	9.0-18.3
Rete testis flow ml/hour	1.65	0.08	0.8-2.25
Sperm concentration/ml RTF × 10^6	116	7	84-162
Production of spermatozoa/hour × 10^6	182.5	13.8	81.6-290

TABLE 2

Correlations of rete testis flow and production of spermatozoa with other parameters.

Rete testis flow ml/hour correlated with :		
— Testis weight	$r = 0.69$	$P = 0.01$
— Tubular wall area	$r = 0.62$	$0.05 > P > 0.01$
— Total volume of intertubular tissue	$r = 0.52$	$0.1 > P > 0.05$
— Individual Leydig cell volume	$r = 0.62$	$0.05 > P > 0.01$
Production of spermatozoa/hour correlated with :		
— Testis weight	$r = 0.56$	$P = 0.05$
— Seminiferous tubule length	$r = 0.51$	$0.1 > P > 0.05$
— Tubular wall total area	$r = 0.61$	$P < 0.05$
— Total volume of intertubular tissue	$r = 0.51$	$0.1 > P > 0.05$

Rete testis flow was significantly correlated with testicular weight ($r = 0.69$, $P = 0.01$), the total area of seminiferous tubules ($r = 0.62$, $P < 0.05$) and individual Leydig cell volume ($r = 0.62$, $P < 0.05$). The correlation with the total volume of intertubular tissue per testis was not significant ($r = 0.52$, $0.1 > P > 0.05$).

Concentrations of spermatozoa in RTF were not correlated with any histological parameter.

Sperm production per testis and per hour was significantly correlated with testis weight ($r = 0.56$, $P = 0.05$) and tubular wall area ($r = 0.61$, $P < 0.05$). Neither the correlations with the total length of seminiferous tubules per testis ($r = 0.51$, $0.1 > P > 0.05$) or with the total volume of intertubular tissue per testis were significant. Moreover 66 % of the variation in rete testis flow was explained by a combination of the total area of seminiferous tubule wall per testis and the mean individual Leydig cell volume per testis ($r^2 = 0.657$, $F = 9.579$, $P = 0.01$).

Discussion.

The flow of the rete testis fluid was significantly correlated with the total area of seminiferous tubule wall per testis, indicating that the surface available for filtration through the wall of seminiferous tubules is a major element controlling the flow rate. This area depends on the diameter and length of the seminiferous tubules and these dimensions are known to vary according to season and endocrinological status (Hochereau-de Reviers *et al.,* 1976 ; Courot *et al.,* 1979).

Rete testis flow was also correlated with the mean individual Leydig cell volume. It has been claimed previously that the size of the individual Leydig cell is related to its LH receptivity (Barenton *et al.,* 1982) and to testosterone production (Neaves, 1976). This indicates the role played by testosterone in controlling either the development of the tubular wall or fluid transfer from the intertubular to the tubular compartment. It has been proposed that tubular wall development is under testosterone control in the young growing rat (Bressler, 1978).

The production of spermatozoa is correlated with the area of the seminiferous tubule wall. Moreover, it is possible that tubular wall development as well as sperm production are partly controlled by the number of Sertoli cells.

Reçu en janvier 1984.
Accepté en mars 1984.

Acknowledgements. — We are grateful to the Animal Hospital staff (J. C. Vallet and collaborators) for their skilled help, to Dr. M. Courot for reviewing the manuscript, to Dr G. Martin for the English translation and to Mrs G. Ploux for typing the manuscript.

Résumé. *Relation entre la sécrétion du liquide du* rete testis *et la structure du testicule chez le bélier.*

La technique de cannulation du rete testis a été utilisée pour comparer la sécrétion du fluide testiculaire à la production de spermatozoïdes et aux paramètres histologiques du tes-

ticule chez des béliers Ile-de-France. 13 testicules ont ainsi été opérés. Le débit horaire du liquide de rete testis est significativement corrélé ($P < 0,05$) au poids testiculaire, à la surface de la paroi des tubes séminifères, et au volume individuel des cellules de Leydig. Ces deux derniers facteurs expliquent à eux deux 66 % de la variation du débit de fluide.

References

BARENTON B., HOCHEREAU-de REVIERS M. T., PERREAU C., POIRIER J. C., 1982. Effects of induced hypoprolactinaemia in the ram : plasma gonadotrophin levels, LH and FSH receptors and histology of the testis. *Reprod. Nutr. Dévelop.*, **22**, 621-630.

BRESSLER R. S., 1978. Hormonal control of post-natal maturation of the seminiferous cord. *Ann. Biol. anim. Bioch. Biophys.*, **18**, 535-540.

COUROT M., HOCHEREAU-de REVIERS M. T., MONET-KUNTZ C., LOCATELLI A., PISSELET C., BLANC M. R., DACHEUX J. L., 1979. Endocrinology of spermatogenesis in the hypophysectomized ram. *J. Reprod. Fert.*, Suppl. **26**, 165-173.

COUROT M., ORTAVANT R., 1981. Endocrine control of spermatogenesis in the ram. *J. Reprod. Fert.*, Suppl. **30**, 47-60.

DACHEUX J. L., PISSELET C., BLANC M. R., HOCHEREAU-de REVIERS M. T., COUROT M., 1981. Seasonal variations in rete testis fluid secretion and sperm production in different breeds of ram. *J. Reprod. Fert.*, **61**, 363-371.

HOCHEREAU-de REVIERS M. T., LOIR M., PELLETIER J., 1976. Seasonal variations in the response of the testis and LH levels to hemicastration of adult rams. *J. Reprod. Fert.*, **46**, 203-209.

HOCHEREAU-de REVIERS M. T., BLANC M. R., CAHOREAU C., COUROT M., DACHEUX J. L., PISSELET C., 1979. Histological testicular parameters in bilateral cryptorchid adult rams. *Ann. Biol. anim. Bioch. Biophys.*, **19**, 1141-1146.

NEAVES W. B., 1976. Cytologic correlates of testosterone production, 35-41. In C. H. SPILMAN *et al., Regulatory mechanisms of male reproductive physiology. Excerpta med.*, Amsterdam, The Netherlands.

ORTAVANT R., 1959. Le cycle spermatogénétique chez le bélier. *Ann. Zootech.* (Paris), **8**, 271-321.

SNEDECOR G. W., 1956. *Statistical methods applied to experiments in agriculture and biology.* Ed. 5. Iowa State Univ. Press, Ames.

WAITES G. M. H., GLADWELL R. T., 1982. The physiological significance of fluid secretion in the testis and blood testis barrier. *Physiol. Rev.*, **62**, 624-672.